SECTION 3. APPROVAL OF PERFORMANCE DATA SECTIONS OF CFM's

975. GENERAL. This section contains information and guidance to POI's for reviewing and approving the presentation of performance data in company flight manuals (CFM's). For guidance on the approval of manuals see volume 3, chapter 15, section 2.

A. *Performance Data Computation Systems.* A performance data computation system is defined as the system the operator uses to produce the data required to operate an airplane within the performance limitations specified in the airplane flight manual (AFM) and Subpart I of either Part 121 or Part 135, as applicable. The performance data computation system consists of at least the following components:

- An airport data acquisition, maintenance, and dissemination system (a necessary subsystem for all airplanes operated under Parts 121 and 135)

NOTE: The majority of this data is available from commercial and government aeronautical charting services. Operators of large transport and commuter category airplanes, however, require obstacle data for takeoff computations that are more detailed than those usually supplied by a standard charting service. Operators may contract for obstacle data from commercial sources or may collect the data themselves. Specific guidance for the acceptance or approval of airport data acquisition systems is in section 4 of this chapter.

- Performance data for each variant aircraft the operator operates in a format readily usable by the flightcrew (This data may be obtained from the AFM directly or purchased in a digital format suitable for computer processing.)

- Manual computation procedures or a computer algorithm for converting aircraft performance data from the AFM format to the format used by the flightcrew (The system must make all necessary computations for determining the maximum allowable weight for takeoff and for determining the V speeds to be used at the selected weight.)

B. *Current Industry Practices.* There are a wide range of methods for: collecting airport and obstacle data; preparing airport analyses; and, for preparing, publishing, and distributing the performance data sections of CFM's. To implement each or all of these functions, operators may either establish a department within the company or contract the work out. Operators may contract for the collection of airport and obstacle data but produce the airport analysis in-house. Other operators may supply airport data to aircraft manufacturers or other contractors who prepare the airport analysis. Generally, major airlines do more of this process in-house, while smaller operators contract for these services. Some service contractors provide services tailored specifically to Part 121 supplemental and Part 135 on-demand operators.

C. *Approval Criteria.* POI's may approve any method of performance data computation and presentation that meets the following criteria:

(1) The system must make all of the computations required in the AFM and in the pertinent operating rules (see section 2 of this chapter for a description of these factors for specific airplanes).

(2) Provisions must be made in the system for all makes, models, and variations of aircraft used by the operator.

(3) The system must account for all pertinent variables such as temperature, weight, thrust, runway condition, and obstacles.

(4) The system must be appropriate to the operator's requirements. Large, highly-complex airplanes usually require very different systems from those required for small, simple airplanes.

(5) The system must be reliable in that identical answers must be generated each time the process is entered with identical parameters.

(6) The system must be accurate in that it generates performance data that agrees with AFM data within the degree of accuracy inherent in the original AFM data. For example, when the AFM data is accurate to $\pm$ 2%, the operator's system must produce results that do not deviate from the AFM data by more than $\pm$ 2%.

(7) The system should be relatively simple, easy to use, and not error-prone.

(8) When simplifying assumptions are made, those assumptions must be clearly and completely stated in the operator's CFM or GOM as operator-imposed limitations (for example a maximum field elevation of 4,000 feet and minimum runway length of 5,000 feet). When the assumptions cannot be met, the actions to be taken by the flightcrew, flight followers, and dispatchers must be clearly specified. In such cases, operations must be prohibited or alternate procedures specified.

(9) The flightcrew procedures for generating, obtaining, and verifying data must be thoroughly described in the procedures section of the CFM. In the case of the same procedure applying to all airplanes, the flightcrew procedures must be described in a section of the GOM.

977. MANUAL COMPUTATION SYSTEM FROM AFM DATA. Operators may choose to have flight crewmembers, dispatchers, or flight followers conduct manual data computations from the AFM performance section for each takeoff. Equipment is not necessary to establish the manual computation system. This system is flexible because it can be used for any runway for which the required input parameters can be obtained. The disadvantage of such a system is that computations can be difficult, complex, time-consuming, and error-prone. Flight crewmembers, flight followers, and dispatchers must be carefully and thoroughly trained in such a system. Flightcrews must be supplied with the location of the controlling obstacle for each runway used. While this system is widely used for small airplanes, it is impractical for the routine operations of large airplanes because of the complexity of the required computations and the high probability of human error. The system is, however, available to the operator for backup in the case of computer failure and for special one-time requirements.

979. TABULATED DATA METHOD. AFM data may be combined with airport and runway data and published in tabular format. The product of this tabulated data method is usually termed an airport analysis. Typically, the flightcrew is provided with a table for each runway and flap setting. The flight crewmember enters the temperature on the table to determine maximum allowable takeoff weight and then enters the actual weight to determine the V speeds. Additional corrections are required for factors such as wet or contaminated runways and winds.

A. Tabulated data is easier to use, less error-prone and requires less training than is required for AFM data. A properly designed CFM system retains most of the operating flexibility of the AFM system. A tabulated data system reduces, but does not eliminate, human error. A disadvantage of the tabulated data system is that crewmembers must maintain an up-to-date chart for each runway from which operations are authorized. A means must be available to transmit current charts to the flightcrew before they are needed. Provisions must be made for temporarily shortened runways.

B. The operator must be capable of generating performance data tables which retain the degree of accuracy inherent in the AFM data. Generally, this must be done manually, by carefully picking data points from a graph, entering the data into a computer, and carefully verifying the generated points. The amount of work required to prepare tabulated data from an AFM often precludes operators from generating their own data packages. Most often the operator will be required to buy a digital data package from the manufacturer from which to generate the required tables. POI's may approve other sources, however, when the operator can adequately establish the accuracy of the data.

C. The operator's system must be capable of performing all of the required computations for each takeoff situation, including the selection of the correct controlling obstacle for each flap setting.

981. SIMPLIFIED DATA METHOD. A simplified data system is based on a specified set of assumptions about the conditions under which the aircraft will be operated. For example, takeoffs might be limited to runways longer than 5,000 feet and less than 4,000 feet elevation. In this system, the crew is supplied with a simple chart or set of cards which gives the V speeds at specified weight increments. This chart is used on all runways. The operator performs an airport analysis for each airport served and demonstrates that when the aircraft is operated in accordance with the specified set of assumptions, it will perform either equal to, or better than, the performance required in the applicable regulations on all runways the crew is authorized to use. Some of the system's advantages are: its relative simplicity, the lack of crew error, the ease of crew training, and the speed with which the crew can determine V speeds. Some of the system's disadvantages are: it often imposes severe performance penalties on operators, it is inflexible, and operations must either be terminated or an alternate system used when the simplifying assumptions cannot be met (for such conditions as: construction, part of runway closed, ice, rain, or shortened runways). The system is best suited for operators who serve a limited number of locations regularly and who operate either at large airports, near sea level, or

at moderate temperatures.

983. REAL TIME METHOD. A real time data system is one in which the required computations are made immediately before takeoff for every flight. Usually the data is relayed to the flightcrew by radio or through ACARS. The advantages of such a system are that it is extremely flexible, up-to-date, and efficient. Changes in obstacles due to construction, weight, temperature, and runway can be handled immediately. Also, the operator can take maximum advantage of the performance capabilities of the airplane. Some disadvantages of the system are that it is expensive, it requires extensive equipment and highly trained personnel to operate, and that adequate backup must be available should the main computer go off-line. The operator must be able to collect all of the required data, process it, and transmit it to the crew quickly.

985. EVALUATION OF AN OPERATOR'S SYSTEM. Generally, POI's do not have the capability to verify each data point when approving the performance data section of a CFM. The validity and reliability of the computation system itself, however, can be evaluated.

A. POI's shall require the operator to provide an analysis, with documentation, of the following:

- Source of the computer program
- Assumptions on which the computer program is based (for example, they must determine if the correct factors are used for each type of aircraft; see section 1)
- Source and accuracy of the databases used
- Operator's capability for handling data
- Results of parallel manual calculations made with AFM data to confirm results

B. The POI should coordinate with the PMI to ensure that the operator's airplanes meet the specifications of the certification regulations. For example, a small airplane may have been modified to install more than the original nine seats. To qualify under the additional airworthiness standards of Part 135, Appendix A, several modifications that require supplemental type certificates may have been required. Unless all of the required modifications have been completed, the airplane may not qualify for the proposed operation.

C. When the operator contracts for data or computation, the operator is responsible for the validity of the results. A POI may find that the contractor has been previously evaluated and approved for another operator. The POI may approve reputable sources for these services that have been previously evaluated without the documentation discussed in previous subparagraph A. POI's who are concerned about a specific contractor's qualifications should contact the regional flight standards division (RFSD), who may, in turn, coordinate with AFS-200. If the contractor's capabilities and qualifications have not been previously established, the POI shall require the operator to fully substantiate the contractor's qualifications before granting approval to the operator system.

D. Operators should procure computer programs from a reliable source. The computer programmers should be qualified in both education and experience. The validity of the computer program should be validated by aeronautical engineers and computer specialists.

E. All of the calculations required in the regulations for the type of airplane involved (as discussed in section 1) must be performed, including en route and destination calculations.

F. For real time systems, the operator's method of obtaining data for a specific flight and for transmitting that data to and from the individual performing the calculations must be shown to be accurate and timely.

G. The POI or a designated inspector should review the verification process conducted by the operator. Several runways at different airports should be selected for verification with the AFM data. Short runways with obstacles should be checked by manual calculation, particularly at airports with higher temperatures and elevations.

(1) The operator should be able to identify all of the obstacles evaluated by the computer and the one selected as the limiting obstacle in each case. The POI must be aware that under different temperature and weight conditions, a different flap setting may be required, and different obstacles may be controlling. The inspector should ensure that the operator has verified the limiting obstacle under various conditions and flap settings.

(2) The POI should contact the RFSD or the

applicable AEG through the RFSD for assistance when technical problems arise.

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